COORDINATION AND SELECTION OF MV AND LV FUSES FOR DISTRIBUTION TRANSFORMER PROTECTION

D.D.K.G.Sandasiri

(08/8404)

Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa

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DapanaDurageKasunGeenathSandasiri

(08/8404)

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Department of Electrical Engineering

University of Moratuwa

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DECLARATION

The work submitted in this dissertation is the result of my owninvestigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not beingconcurrently submitted for any other degree.

D.D.K.G. Sandasiri
Date: 15th March 2013

I endorse the declaration by the candidate.

Prof. J.R Lucas
Senior Professor
University of Moratuwa

ABSTRACT

The Ceylon Electricity Board (CEB) has the responsibility of distributing electricity to the consumers in Sri Lanka except few areas which belong to the Lanka Electric Company (LECO). When considering about the distribution network, distribution transformers play the major role. Protection of transformers is therefore very much important. Transformer failure rate and the distribution network reliability are major concerns of the CEB. Distribution transformer failure rate is high in theCEB network and also the fuse usage is unacceptably high.

Present CEB fuse selection practice and practical situation at the field have been analyzed to find out better solution for above problems. Theory behind distribution transformer fuse selection has been discussed in detail. K type expulsion fuses are the recommended primary side fuses by the CEB. The study has proposed several changes to the existing fuse selection practice recommended by the CEB.

The present distribution transformer protection scheme do not provide over load protection. It has been identified that nearly 13% transformers had failed annually due to over load within the Southern Province. The study revealed that lower capacity of transformers such as 100kVA and 160kVA have the higher probability of getting overloaded. Furthermore, 15% of distribution transformers installed in the Southern Province have at least one phase overloaded.

A Primary side K type fuse does not provide overload protection to the distribution transformer. Hence, secondary side fuse should provide the over load protection but above findings tell that the expected task cannot be achieved by the present system. The study has proposed three options to solve this problem. Introduction of a primary fuse which is having special Time Current Characteristic (TCC) curve is the first option. The fuse type is called “SloFast” and it has a duel TCC curve.The SloFast fuse TCC curve behaves very much parallel to the transformer damage curve at some low level of current unlike K type fuse TCC curve, which intersects transformer damage curve at some low level of current.

The second option is adding a main secondary fuse in between the transformer secondary terminal and the feeder fusses. So that the feeder fuse does the overload

protection of the feeder conductor and the main secondary fuse does the overload protection of distribution transformer.

The third option is limitation of the number of outgoing feeders from a transformer. This is very important for the distribution transformers having low capacities such as 100kVA and 160kVA, because the probability of getting overloaded is high with the present feeder arrangement. It is recommended the maximum number of feeders for each distribution transformer capacity.

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LIST OF ABBREVIATIONS

Abbreviation	Description
CEB	Ceylon Electricity Board
IEEE	Institute of Electrical and Electronic Engineers
MV	Medium Voltage
LV	Low Voltage
DDLO	Drop Down Lift Off
HRC	High Rupturing Capacity
MCCB	Molded Case Circuit Breaker
TCC	Time Current Characteristic